ACOUSTICS2008/850
Hard times for the pitch of complex sounds in reverberant environments

Mark Sayles and Ian Winter
Centre for the Neural Basis of Hearing, The Physiological Laboratory, Downing Street, CB2 3EG
Cambridge, UK

Reverberation is present in most everyday listening environments, with sound reaching our ears directly from the source(s), and indirectly after reflecting from nearby surfaces. Reverberation smears spectral transitions through time and disrupts temporal envelope modulation in harmonic complex sounds such as voiced portions of speech. Envelope modulation can provide a cue to the pitch of complex sounds and is relied upon by hearing impaired listeners. We have examined the effects of reverberation on the temporal representation of the dynamic pitch of frequency-modulated harmonic complex sounds in the responses of single units from the ventral cochlear nucleus. Without reverberation most units provide a strong representation of the modulated pitch in their short-term interspike interval distributions. Relatively mild reverberation degrades the representation based on envelope modulation, whilst more severe reverberation removes it. The representation of pitch based on fine structure is more robust to the effects of reverberation; however, this representation is smeared in time by indirect sound energy. The effects of reverberation are critically dependent on the neuron's best-frequency, source-to-receiver distance, fundamental frequency and frequency modulation rate. We observe comparable results in human listeners using the same sounds.